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SOUTHWEST FISHERIES CENTER

NATIONAL MARINE FISHERIES SERVICE

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**DOCUMENTATION OF PROCEDURES
AND COMPUTER PROGRAMS
USED FOR FOOD-HABIT ANALYSIS
OF CALIFORNIA SEA LION (*Zalophus
californianus*) SCATS AND SPEWINGS**

by

Mark S. Lowry

ADMINISTRATIVE REPORT LJ-86-04

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CALIFORNIA SEA LION (ZALOPHUS CALIFORNIANUS)
SCATS AND SPEWINGS

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INTRODUCTION

In 1981 the National Marine Fisheries Service, at the Southwest Fisheries Center (SWFC), began a study on the food habits of California sea lions (Zalophus californianus) in southern California. Fecal material (scats) and vomitus (spewings) from sea lions were collected at rookeries and haulout sites located on islands off southern California. Prey were identified from fish otoliths, cephalopod beaks, or other prey remains recovered from the scats and spewings. This report documents (1) procedures for collecting scats and spewings; (2) methods for processing scat and spewing samples; (3) database editing procedures and software programs; (4) data archival in a database; and (5) software programs used to extract information for producing reports on California sea lion food-habits.

The database (SCATDB.DAT) will accommodate any pinniped species from any area.

COLLECTION OF SAMPLES

Specific areas, or locations within large areas, at a sea lion rookery were monitored by first clearing all scats and spewings at the beginning of the study. Upon subsequent visits scats and spewings would be collected, or destroyed once enough samples were collected from these areas.

Scat and spewing samples were collected individually by hand and placed in a plastic bag (i.e. Whirl-pak¹, Zip-lock¹, or Baggie¹). A label was included in either the bag containing a single sample, or in a larger bag containing several bags of samples from one location. The label contained information on (1) where the sample was collected (island, area, and specific location); (2) collection date; and when known (3) the kind of animals (i.e. females, pups, subadult males, etc.) hauled out at

¹ Reference to trade names does not imply endorsement by the National Marine Fisheries Service, NOAA.

that location or area. The samples were then stored collectively in an air tight plastic bucket. After returning from the field the bucket was stored in a large walk-in freezer until the samples were processed.

Each sample collection time-period was assigned a code number designating either a group of days or one day when samples were collected and subsequently recorded onto a data form during sample processing (refer to DATA ENTRY section for further details). The number of days assigned to a collection period depended on the interval between collections. Days close to each other were grouped together if separated by several days or weeks. Single days were assigned their own collection code number if samples were collected on one day with long time periods before and after the collection, or if collections were made during consecutive days over a long period of time.

SAMPLE PROCESSING

After thawing, each sample was individually soaked in water containing a small amount of liquid dish soap to soften the sample before screening. A waterproof paper label with information written with a soft-leaded pencil was inserted in each sample bag prior to soaking. This label contained the collection date, assigned serial number for the sample, and the initials for the island where the sample was collected. The same information was also recorded onto a data form (refer to DATA ENTRY section for further details). All samples were then stored in an air tight plastic container during soaking. Fresh scats could be screened within one hour after being soaked, while dry scats required at least 24 hours of soaking time. No samples were soaked for more than two weeks prior to screening.

An approximate volume for each sample was obtained by squeezing residual water out of the sample bag. Rocks and other debris were removed prior to measuring the volume of the sample, or their volume was subtracted from the measured sample volume. The sample was then rinsed through a set of nested sieves. Clumps of sample material were broken down gently by hand while water was sprayed on the sample. The largest mesh-size sieve used was 2.8 mm with a mesh size of 0.710 mm preferred for the smallest sieve. The 1.0 mm mesh size was found to be too large to be used as the smallest sieve size. Some sorters preferred to use a 1.5 mm sieve between the 2.8 mm and the 0.710 mm sieves.

Fish otoliths and cephalopod beaks were removed from the sample during the rinsing process and placed separately into test tubes containing 70% ethanol. The otoliths and sample identification label that was in the sample while it soaked were air dried after the sample was sorted and then placed in a dry test tube. Cephalopod beaks were stored in a test tube with 70% ethanol and either a new label was prepared if otoliths were in the sample, or if no otoliths were found then the same label that was placed in the sample bag during soaking was placed in

the test tube containing the beaks. All test tubes for a collection period were collectively stored in a test tube rack until prey identifications were made from the collected material (e.g. otoliths or beaks). The presence or absence of fish bones, fish otoliths, cephalopod beaks, pelagic red crab (Pleuroncodes planipes) fragments, parasites, fish eye lenses, and cephalopod eye lenses were recorded onto the data sheet. Parasites and other prey remains were sometimes collected depending on their condition. These were either stored in 70% ethanol or air dried.

A binocular dissecting microscope was used to separate and identify fish otoliths and cephalopod beaks. Otoliths and beaks were identified to the lowest taxonomic level possible using reference material from identified specimens and published photographs or drawings of identified material. Left and right sagittal otoliths were separated and counted for each prey. Upper and lower cephalopod beaks were also separated and counted for each prey. Unidentified otolith and beak fragments, and secondary otoliths (asteriscus and lapillus), were noted as either present or absent. The information from the otoliths and beaks were all recorded onto a data form (refer to DATA ENTRY section).

Otoliths were stored in gelatin capsules (size No. 0) with each capsule containing the prey name(s), collection date, serial number, and island initials written with a fine point (No. 0 or 00) rapidograph pen. All capsules were then stored collectively by collection period, or other grouping in whirl-pak plastic bags. These smaller bags were then enclosed in a larger plastic bag according to year and origin. Gelatin capsules were kept dry to prevent them from dissolving.

Cephalopod beaks were stored by species in a vial (2ml, 5ml, or larger depending on the quantity and size of the beaks) containing 70% ethanol and the label with species name, sample code number, and island initials. All vials were then stored in boxes by species and origin.

DATA ENTRY

During laboratory processing, data were collected and recorded for each sample on a computer formatted data form (Figure 1). A description of the variables, definitions and codes appear in Appendix 1 for this form. If a sample yielded material for identification of prey, a second computer formatted data form was used for each prey identified from the sample (Figure 2). The description of the variables, definitions and codes for this form appear in Appendix 2. One exception to the latter occurs for pelagic red crab (Pleuroncodes planipes) fragments. When found during sample rinsing, these were coded on form 1, character 47 (1.47) (see Appendix 1 for codes).

Instructions for coding onto the two forms (Figure 1 and 2) are found in Appendices 1 and 2, respectively and contain coding procedures and codes. All codes are shown for each field

described in the instructions except for (1) collection period codes and (2) prey codes. These are presented in Appendix 3 and 4, respectively.

The database was designed to accommodate the creation of additional codes whenever needed. The date of last revision to the coding instructions (Appendix 1 and 2) and prey codes (Appendix 4) are changed after new codes are assigned and entered. Collection period codes (Appendix 3) are added sequentially for each island or mainland rookery/haulout as the samples are collected.

DATA EDITING

Once samples were coded they were keypunched onto a computer tape and subsequently transferred to a computer disk on a VAX computer. Each keypunched data file was named NEWS CAT.DAT. NEWS CAT.DAT is a temporary data file used for editing new data before they are appended onto the main database called SCATDB.DAT. There are three steps in the NEWS CAT.DAT edit process before it is appended onto SCATDB.DAT. A flow chart describing these steps, and the computer programs used, is shown in Figure 3.

There are three FORTRAN language computer programs used on these data during the data editing sequence. These programs perform a series of procedures which include (1) determining if the data file is in proper sequential order, (2) determining if variables are within specified range values, and (3) comparing variables according to user-defined logical criteria.

The source program SCATEDIT2.FOR must be compiled and linked by the command file SCATLK.COM to produce the executable program file SCATEDIT2.EXE. Each time range values or logical comparison criteria are changed in SCATEDIT2.FOR, this compilation and linking must be performed again, and will result in a new SCATEDIT2.EXE file. The command file SCATEDIT2.COM is then executed. This command file performs three separate functions. First, the data file NEWS CAT.DAT is sorted in a specified sequential order. Then the first of three FORTRAN programs are executed. The program CS00ST2.FOR checks the sorted data file for proper sequence of records. The program stops and the user must correct the data and begin again when errors are found. A listing of the records in question are listed within a file called SCATEDIT2.LOG. If the data file is found by CS00ST2.FOR to be in proper sequential order, the second program SCATEDIT2.FOR performs both range value and logical comparisons editing of the data file. The specifications for range values are shown in Appendix 5 and for logical error criteria in Appendix 6. If the data are in disagreement with the specified criteria, the program produces a listing of the records in question within a file called SCATEDIT2.LOG. This file is reviewed by the user who determines if the data is acceptable. The process is repeated until all of the data is determined to be acceptable.

A third computer program (SEEDIT2UNQ.FOR) is then executed by the command file SEEDIT2UNQ.COM. This program determines if there are any duplicate prey codes with the same identification certainty code for each sample record, and indicates their occurrence in a file called SEEDIT2UNQ.LOG. The output is reviewed by the user who corrects the data file and re-executes the edit program until there are no duplicate prey codes in the data file.

The final step in editing involves appending the new data contained in NEWSCAT.DAT to the master database SCATDB.DAT. The command file AFTEREDIT.COM appends the new data to the master database, then sorts the master database. NEWSCAT.DAT is deleted by the user after checking the appended master database SCATDB.DAT to verify that the new data was added and sorted properly by the command file AFTEREDIT.COM. The master database SCATDB.DAT is copied onto a separate data file called SAFE.DAT to provide a backup to SCATDB.DAT.

DATA EXTRACTION

A. Description of programs

The data stored in the master database SCATDB.DAT allow for various analyses to be made. All of the data stored in the master database SCATDB.DAT are not accessible with the programs described here because the programs listed in this documentation only examine scats meeting certain criteria. The programs listed here have to be modified or new ones must be created if new criteria are specified. If changes are made to the existing programs, then the new version must be re-compiled and linked to create a new name.EXE file (e.g. PREYOKUR.EXE) before running the programs containing the new criteria. The criteria which the existing programs use are:

1. Only scats from California sea lions are examined.
2. Only single scats are examined. Partial scats, several scats that were mixed, or samples containing an unknown number of scats are not examined.
3. Spewings are not examined.
4. The category "fresh scats" includes very fresh scats and partially fresh scats. There is a code for each category and the samples are pooled into the same set of data by the programs.

Therefore, changes must be made to the programs described here or new programs must be written to examine:

1. Spewings
2. Scats or spewings from species other than California sea lions.

3. Fresh versus partially fresh scats.
4. Samples containing more than one scat or spewing.
5. Partial samples of scats or spewings.

Four FORTRAN software programs were created to extract information from the master database SCATDB.DAT to create reports on California sea lion (Zalophus californianus) scats. Descriptions of the four programs are as follows:

1. PREYOKUR.FOR computes the (a) frequency of occurrence and (b) prey composition represented by each prey from the set of scat samples examined. The set of scat samples examined by PREYOKUR.FOR include those with and without coded prey (refer to Appendix 4 for prey codes). Frequency of occurrence describes the number and percentage of scat samples having a particular prey. Prey composition describes the percentage represented by each prey from the occurrences of all prey found in the set of scat samples examined. Appendix 7 contains a detailed explanation on the computations performed by PREYOKUR.FOR and instructions for calculating frequency of occurrence of scats having coded prey from a set of scat samples that may or may not contain coded prey. A flow chart describing the steps used to produce reports using this program is shown in Figure 4. The data processed by PREYOKUR.FOR provide reports for interpreting temporal and between-area differences within one island for the diet of sea lions inhabiting the island.
2. SCATNUM.FOR calculates the frequency and percentage of the minimum number of prey individuals from a given set of scat samples. Appendix 7 contains a detailed explanation on the computations performed by SCATNUM.FOR. A flow chart describing the steps used to produce reports using this program is shown in Figure 5. The scats processed by SCATNUM.FOR provide reports for interpreting temporal and between-area differences within one island for the diet of sea lions inhabiting the island.
3. PREYPER.FOR provides the frequency and percentage of scat samples that have no prey and those that have 1, 2, 3, 4, 5, and >5 different prey per scat. A flow chart describing the steps used to produce reports using this program is shown in Figure 6. The scats processed by PREYPER.FOR provide reports for interpreting temporal and between-area differences within one island for the diet of sea lions inhabiting the island.
4. PREYTOTL.FOR performs the same calculations as PREYOKUR.FOR and SCATNUM.FOR, but uses every scat

collected, including those that represent more than one time-interval between collections (i.e. the scats are >1 collection period old) for each island. A flow chart describing the steps used to produce reports using this program is shown in Figure 8. In some instances, the user may utilize PREYTOTL.FOR for temporal diet analysis if familiar with the data in the database, but it is intended to provide an overview of all prey from every scat collected during a selected time period regardless of how old the scats are.

B. Running the programs:

1. PREYOKUR.FOR

There is a two step process to producing reports by PREYOKUR (Figure 4). The master database SCATDB.DAT is first divided into two sub-files called CPSCAT.DAT and AREASCAT.DAT. The second step uses one of four command files to run the program PREYOKUR.FOR to produce one of four types of reports from the sub-files CPSCAT.DAT or AREASCAT.DAT.

CPSCAT.DAT and AREASCAT.DAT

The command file PRSCATNUM.COM instructs PRSCATNUM.FOR to create sub-files CPSCAT.DAT and AREASCAT.DAT from the main database SCATDB.DAT. These two data sub-files of the main database SCATDB.DAT allow the user to combine scats from different areas or collection periods (i.e. dates of collection). CPSCAT.DAT is sorted by collection period/area, and AREASCAT.DAT is sorted by area/collection period (Figure 4).

Analysis of scats from each island is made possible by creating island-specific data files of CPSCAT.DAT and AREASCAT.DAT from the main database SCATDB.DAT. To create these island specific data files of CPSCAT.DAT and AREASCAT.DAT the command file PRSCATNUM.COM must be edited internally by the user at line 4 by inserting the appropriate two digit island code obtained from Appendix 1. The island specific files are stored and recalled because their island specific nature only allows the user to use data from one island at a time. Storage and recall of CPSCAT.DAT and AREASCAT.DAT is accomplished by the command @STOREAC and @LOADAC.

@STOREAC and @LOADAC

The island-specific sub-files CPSCAT.DAT and AREASCAT.DAT are stored under their own unique island code and are recalled when needed so as to eliminate having to recreate them when they are used for island by island analysis by PREYOKUR.FOR. The created island-specific data files CPSCAT.DAT and AREASCAT.DAT are stored by STOREAC and may be recalled and loaded for processing by LOADAC (Figure 7). The command @STOREAC will convert CPSCAT.DAT and AREASCAT.DAT to the stored version called CPSCAT___.DAT and ARSCAT___.DAT, respectively. The underline

indicates the island code from Appendix 1 that is inserted by the user when prompted by @STOREAC to indicate the island the data belongs to. Similarly, @LOADAC prompts the user for the island code to reactivate the stored files CPSCAT_.DAT and ARSCAT_.DAT into the useable form CPSCAT.DAT and AREASCAT.DAT files needed by PREYOKUR.

Command files

One of four command files, depending on the desired analysis, is used to produce four types of reports from either CPSCAT.DAT or AREASCAT.DAT. These command files use the program PREYOKUR.FOR to process either CPSCAT.DAT or AREASCAT.DAT data files and produce the following reports (Figure 4):

1. SUMOKR.COM uses CPSCAT.DAT to produce a summary report called SUMOKR.RPT for all collection periods and areas combined.
2. COLPEROKR.COM uses CPSCAT.DAT to produce a report called COLPEROKR.RPT by collection period with all areas combined.
3. AREAOKR.COM uses AREASCAT.DAT to produce a report called AREAOKR.RPT by area with all collection periods combined.
4. AREACPOKR.COM uses AREASCAT.DAT to produce a report called AREACPOKR.RPT by collection period and area.

Command file modification

Internal modification of the command files by the user allows for flexibility in analyzing scats. The four command files SUMOKR.COM, COLPEROKR.COM, AREAOKR.COM, and AREACPOKR.COM were created to facilitate the user and lessen the amount of user edit modification, but the user is still required to internally edit these command files. By editing these command files the user has the capability of analyzing scats between different areas, or collected at different times of the year, or combining certain areas and collections from the same island. The user determines how any of the seven lines in these command files are to be modified (or left alone) with the editor prior to running the command file. Generally only line 3 for island code, line 4 for collection period range, and line 6 for area range need to be modified, depending on the command file being used for the analysis desired by the user. The seven prompt lines contained by the command files are:

1. (input file name) -CPSCAT.DAT or AREASCAT.DAT
2. (output file name) -SUMOKR.RPT, COLPEROKR.RPT, AREAOKR.RPT, or AREACPOKR.RPT
3. (island code [see Appendix 1 for the two digit code])

4. (collection period range -e.g., 02-09)

-[refer to Appendix 2 for dates of
collection periods]

5. (combine all collection periods ?) -Yes or No

6. (area range e.g., 01-99)

-[see Appendix 1 for area codes]

7. (combine all areas ?) -Yes or No

Output Data given by PREYOKUR.FOR

The report produced by PREYOKUR.FOR is divided into two segments, each having occurrence and standard occurrence computed, respectively, for each prey code found in the set of scats analyzed. The occurrence segment refers to frequency of occurrence and the standard occurrence segment refers to prey composition (See Appendix 7). The frequency (i.e. number) and percentage represented by each prey is listed in each segment.

Each segment contains results for the three categories of scats: (1) fresh scats; (2) dry scats representing the time interval since the last collection; and (3) the sum of (1) and (2). Fresh and partially-fresh/dry scats are combined into the same set of data by PREYOKUR.FOR (fresh scats are code 1 and partially fresh/dry scats are code 3 in Card 1, character 39 of SCATDB.DAT). The term fresh scats in the report produced by the program, therefore, refer to fresh and partially fresh scats that were examined as one group of data. The dry scats category contains data from dry scats (code 2 in Card 1, character 39 in SCATDB.DAT) having the difference in the collection period and clear date collection period equal to 1. The program PREYOKUR.FOR determines the difference between collection and clear-collection periods for each dry scat by subtracting the clear-date collection period (Card 1, character field 30-32 in SCATDB.DAT) from the collection period (Card 1, character field 13-15 in SCATDB.DAT). These scats are, therefore, one collection period old and are listed as "dry 1 collper" in the reports produced by the program.

Prey that are found in the set of scats examined are listed by prey code number followed by the identification certainty code. A prey code may be repeated as many as three times, but each will have a different identification certainty code. The code numbers for prey are listed in Appendix 4. The identification certainty codes are listed in Appendix 2.

The reports of PREYOKUR also show (1) the total number of scats examined in each category, (2) the sum of the total number of prey/certainty-code occurrences, (3) island code, (4) collection period, (5) collection period range, (6) area range, and (7) area.

2. SCATNUM.FOR

CPSCAT.DAT and AREASCAT.DAT

SCATNUM.FOR utilizes the same CPSCAT.DAT and AREASCAT.DAT as is used by PREYOKUR.FOR. Refer to the section in PREYOKUR.FOR for instructions on creating these data sub-files of the main database SCATDB.DAT for each island.

@STOREAC and @LOADAC

Refer to the section in PREYOKUR.FOR for instructions on utilizing these command files for storing and loading the sub-files CPSCAT.DAT and AREASCAT.DAT for island by island analysis.

Command files

Four command files were created to produce four types of reports. These command files use SCATNUM.FOR to process either CPSCAT.DAT or AREASCAT.DAT data files for producing the following reports (Figure 5):

1. SUMNUM.COM uses CPSCAT.DAT to produce a summary report called SUMNUM.RPT for all collection periods and areas combined.
2. COLPERNUM.COM uses CPSCAT.DAT to produce a report called COLPERNUM.RPT by collection period with all areas combined.
3. AREANUM.COM uses AREASCAT.DAT to produce a report called AREANUM.RPT by area with all collection periods combined.
4. AREACPNUM.COM uses AREASCAT.DAT to produce a report called AREACPNUM.RPT by collection period and area.

Command file modification

The SCATNUM.FOR command files may be modified internally in the same manner as the ones in PREYOKUR.FOR. The structure of the command files is identical to those used for PREYOKUR.FOR. Refer to the section dealing with modifying the command files in PREYOKUR.FOR for modifying the SCATNUM.FOR command files. The only difference between the command files used for PREYOKUR.FOR and SCATNUM.FOR are in the output file name (line 2 of the command file). Substitute the names of the report output files listed above for those listed in the section describing PREYOKUR.FOR.

Output data given by SCATNUM.FOR

SCATNUM.FOR computes the minimum number of prey individuals for each prey and identification certainty code expressed as the number of individuals and their respective percentage

representation (See Appendix 7). This is computed for the same three scat categories used in PREYOKUR.FOR (i.e. fresh, dry "one collper", and both). Prey are listed in the same manner as in PREYOKUR.FOR. The reports of SCATNUM.FOR also show (1) the total number of scats examined in each category, (2) the sum of the total number of prey/certainty-code occurrences, (3) island code, (4) collection period, (5) collection period range, (6) area range, and (7) area.

3. PREYPER.FOR

CPSCAT.DAT and AREASCAT.DAT

PREYPER.FOR utilizes the same CPSCAT.DAT and AREASCAT.DAT sub-files as are used by PREYOKUR.FOR and SCATNUM.FOR. Refer to the section in PREYOKUR.FOR for instructions on creating these data sub-files of the main database SCATDB.DAT.

@STOREAC and @LOADAC

Refer to the section in PREYOKUR.FOR for instructions on utilizing these command files for storing and loading the sub-files CPSCAT.DAT and AREASCAT.DAT for island by island analysis.

Command files

Four command files were created to produce four types of reports. These command files use PREYPER.FOR to process either CPSCAT.DAT or AREASCAT.DAT data files for producing reports (Figure 6):

1. SUMPER.COM uses CPSCAT.DAT to produce a summary report called SUMPER.RPT for all collection periods and areas combined.
2. COLPERPER.COM uses CPSCAT.DAT to produce a report called COLPERPER.RPT by collection period with all areas combined.
3. AREAPER.COM uses AREASCAT.DAT to produce a report called AREAPER.RPT by area with all collection periods combined.
4. AREACPPER.COM uses AREASCAT.DAT to produce a report called AREACPPER.RPT by collection period and area.

Command file Modification

These command files may be modified internally in the same manner as the ones in PREYOKUR.FOR and SCATNUM.FOR. The structure of the command files is identical in all programs. Refer to the section dealing with modifying the command files in PREYOKUR for modifying the PREYPER.FOR command files. The only differences between the command files of PREYOKUR.FOR and SCATNUM.FOR are in the output file name (line 2 of the command

file). Substitute the names of the report output files listed above for those listed in the section describing PREYOKUR.FOR.

Output data given by PREYPER.FOR

The reports produced by PREYPER.FOR identify the number and percentage of scats from a set of scats that have from none to greater than 5 prey (i.e. 0,1,2,3,4,5, and >5) per scat. These data are provided for five categories of scats: (1) fresh scats; (2) dry scats that represent one time interval between collections (i.e. one collection period); (3) the sum of (1) and (2); (4) dry scats older than one-collection-period old; and (5) all scats. The reports of PREYPER.FOR also show (1) the total number of scats examined in each category, (2) island code, (3) collection period, (4) collection period range, (5) area range, and (6) area.

4. PREYTOTL.FOR

The command file PREYTOTL.COM uses the program PREYTOTL.FOR to produce a summary report of all prey found in all the scats collected within the specified range of collection periods and island. PREYTOTL.FOR differs from SCATNUM.FOR and PREYOKUR.FOR by including all single scats collected within the specified range of collection periods regardless of how old the dry scats are. It calculates occurrence, standard occurrence, and minimum number of individual prey on the same table, whereas PREYOKUR.FOR only computes occurrence and standard occurrence, and SCATNUM.FOR only determines minimum number of individual prey. Refer to Appendix 7 for a detailed explanation on the computations performed by PREYTOTL.FOR. PREYTOTL.FOR uses the main database SCATDB.DAT as the input data file, while PREYOKUR.FOR and SCATNUM.FOR use one of two data sub-files (CPSCAT.DAT and AREASCAT.DAT) for input.

Command file modification

The user must edit the command file PREYTOTL.COM prior to running the program. The lines edited refer to the prompts needed by PREYTOTL.FOR. The lines are:

1. (input file name) -SCATDB.DAT
2. (output file name -(e.g. name.RPT)
3. (island code [refer to Appendix 1 for codes] -e.g., 02)
4. (collection period range [refer to Appendix 3] e.g., 01-20)
5. (print the output file) -the output file name specified in line 2 (i.e. name.RPT)

Output Data given by PREYTOTL.FOR

The summary report produced by PREYTOTL.FOR provides data for each prey code found in the set of scats examined. Each of these prey codes are followed by its identification certainty code. The number (N) and frequency represented by each prey is listed for each computation. The percentage of frequencies can be computed by multiplying the frequencies by 100. The report also includes (1) the sum of all occurrences; (2) the sum of all minimum number of prey individuals; (3) the total number of scats examined; (4) island code; and (5) collection period range examined.

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I would like to express my thanks to SWFC computer programmer Jay Walker for helping me create the database format and for all of the programming he did in this project. Also needing my thanks are computer programmers Eugene Sibald and Lily Tang, former National Marine Fisheries Service employees at SWFC, who assisted when Jay was not available.

Figure 1. Coding form for Card 1 of the pinniped scat and spewing database SCATDB.DAT.

Figure 2. Coding form for Cards 2-7 of the pinniped scat and spewing database SCATDB.DAT.

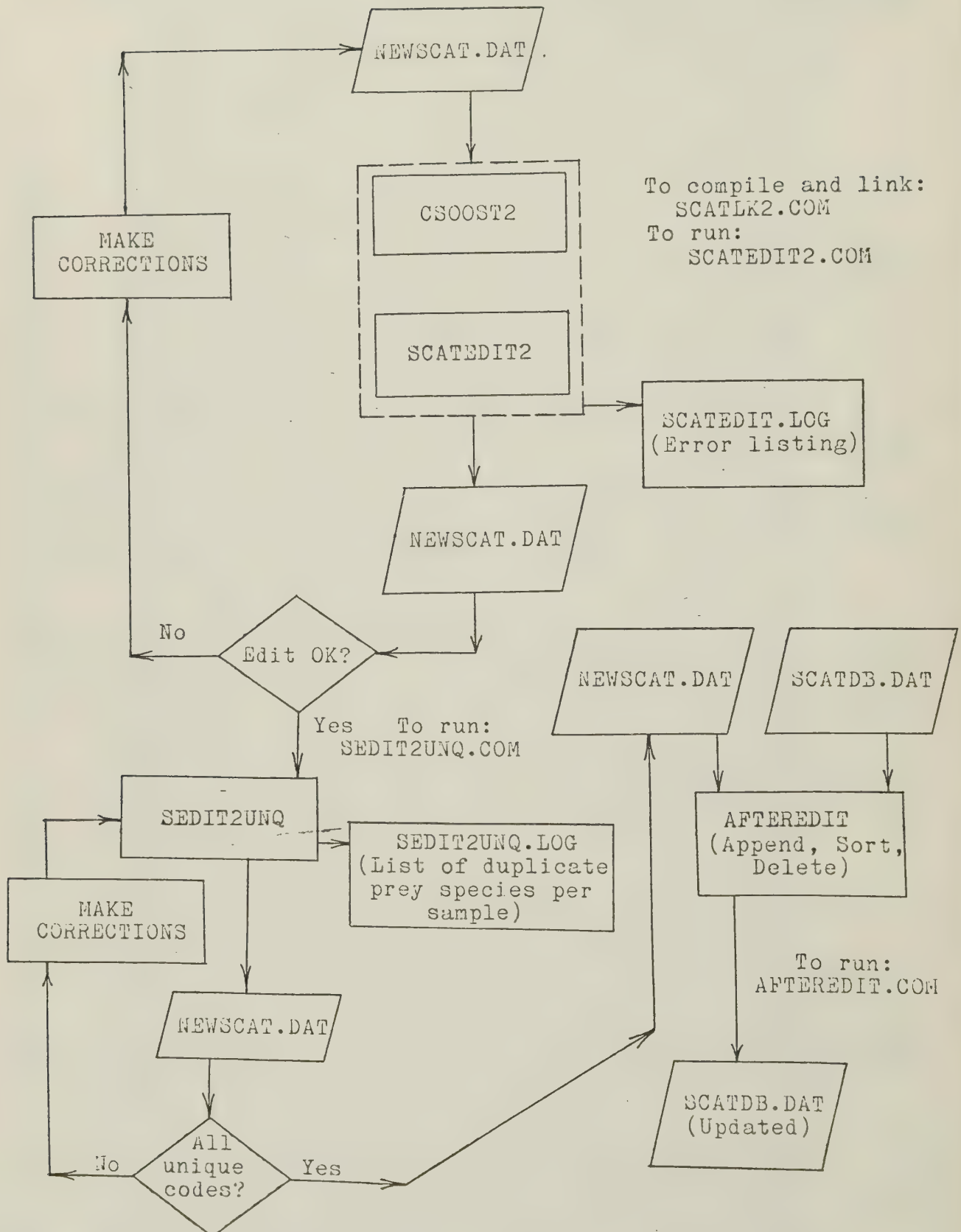


Figure 3. Flow chart of data editing sequence for the pinniped scat and spewing database SCATDB.DAT.

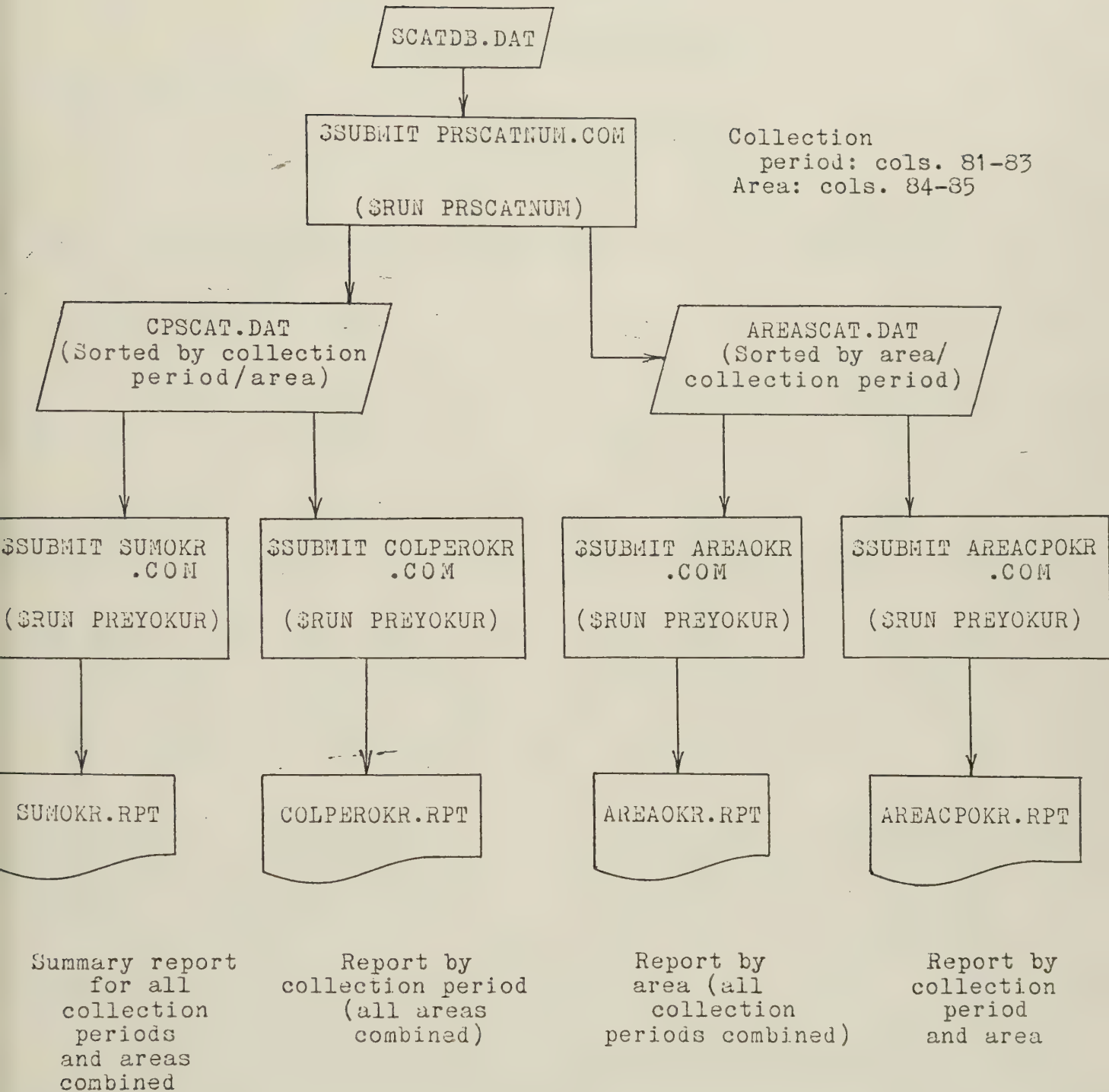


Figure 4. Flow chart of PREYOKUR.

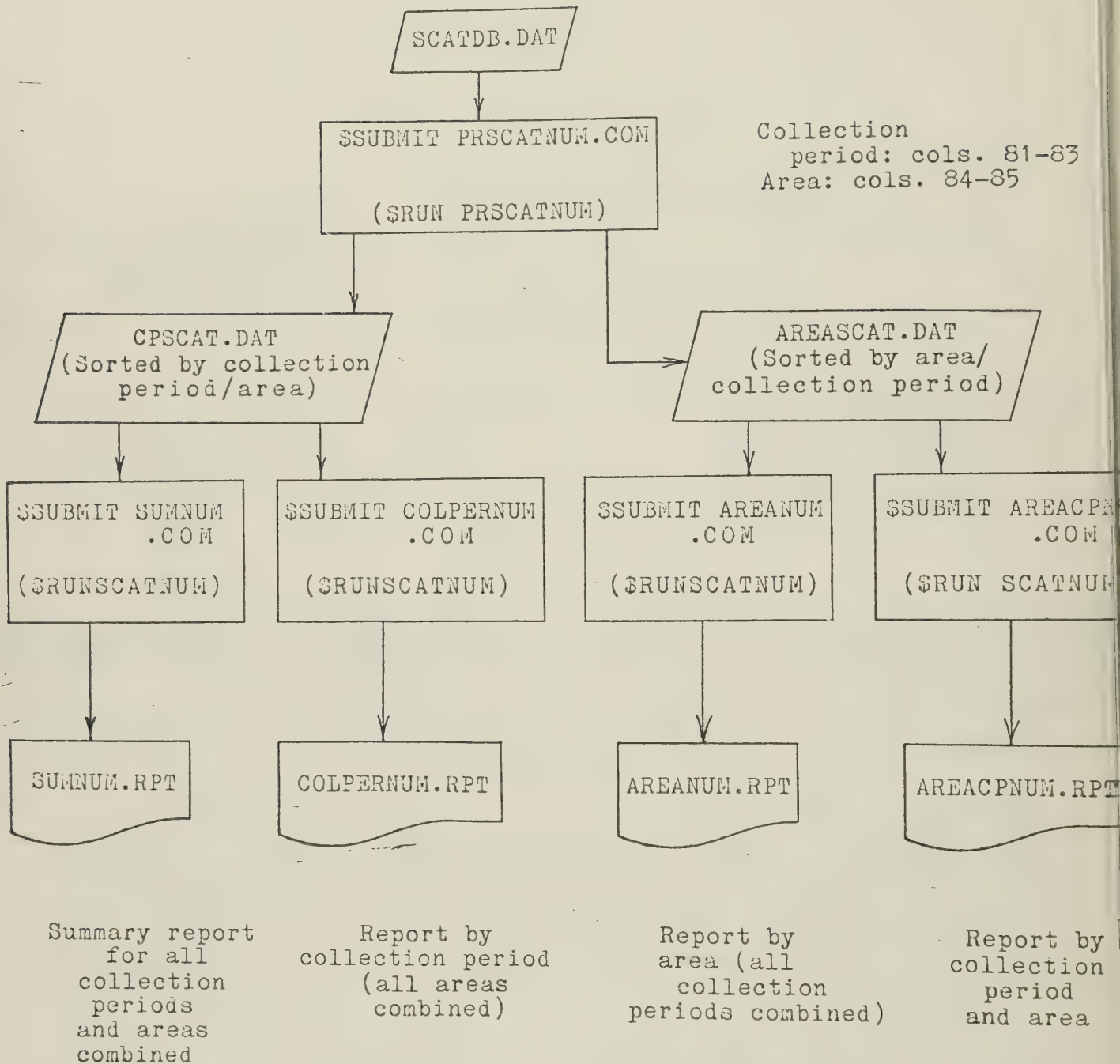


Figure 5. Flow chart for SCATNUM.

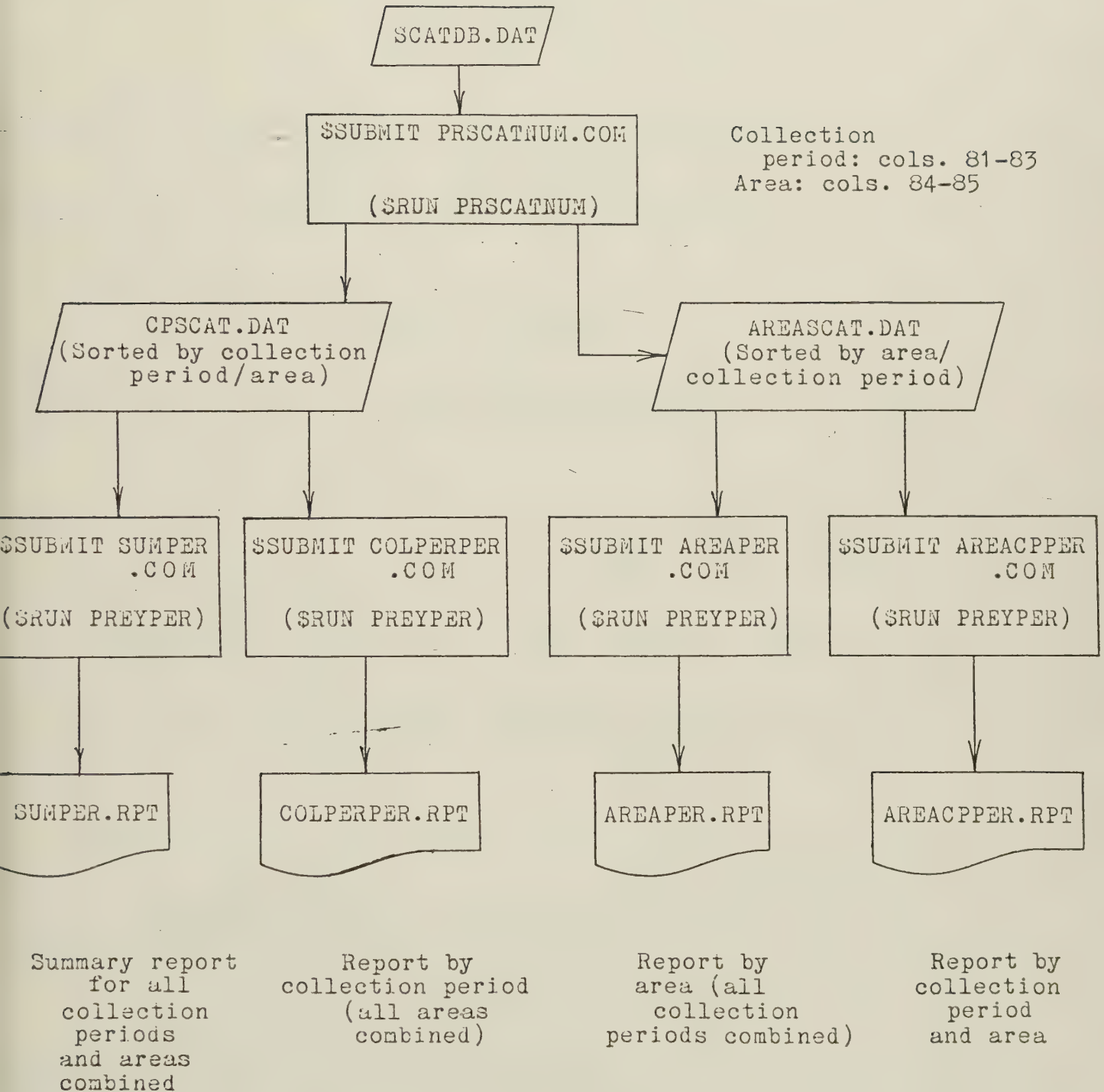


Figure 6. Flow chart of PREYPER.

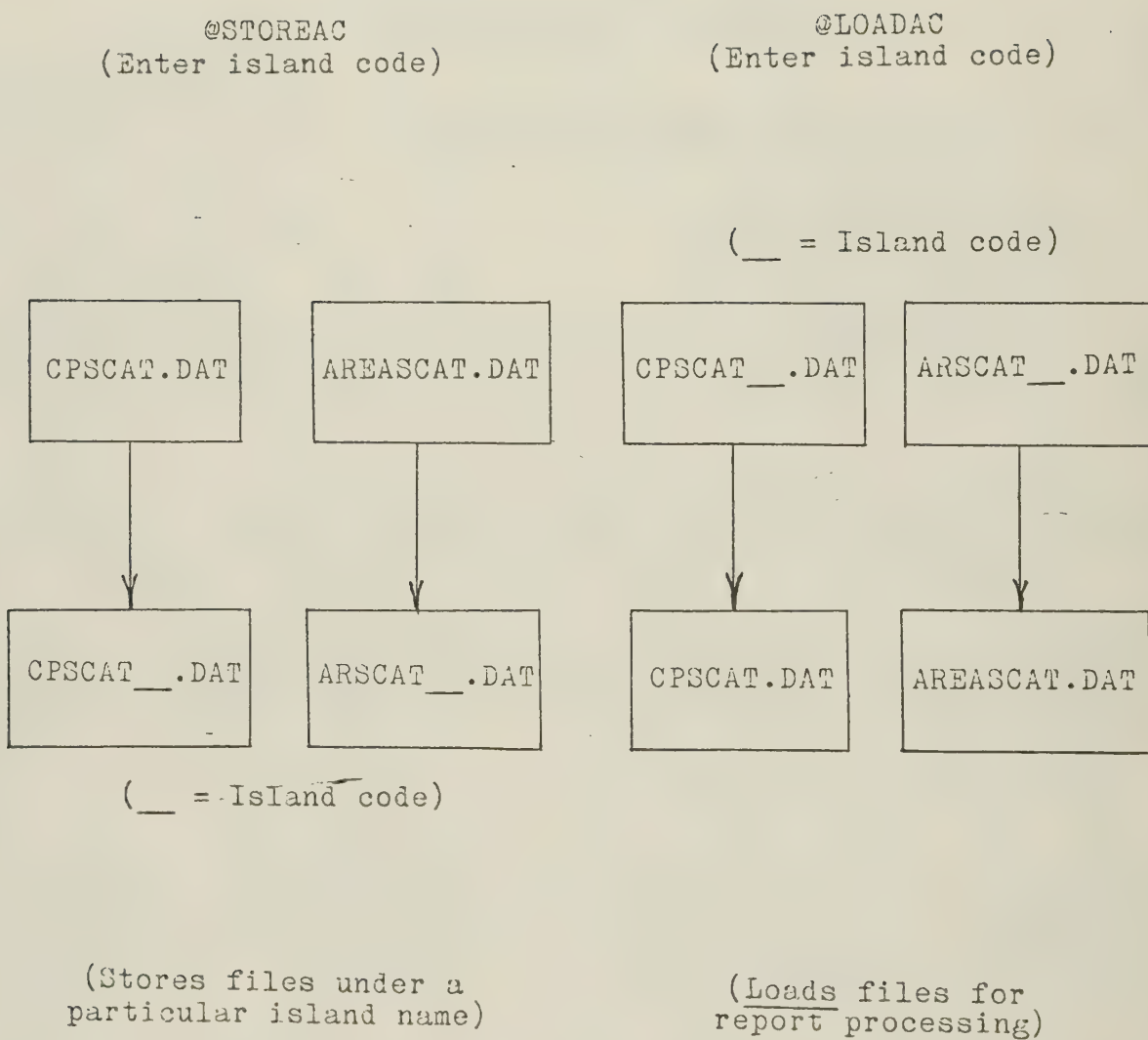


Figure 7. Flow chart for @STOREAC and @LOADAC.

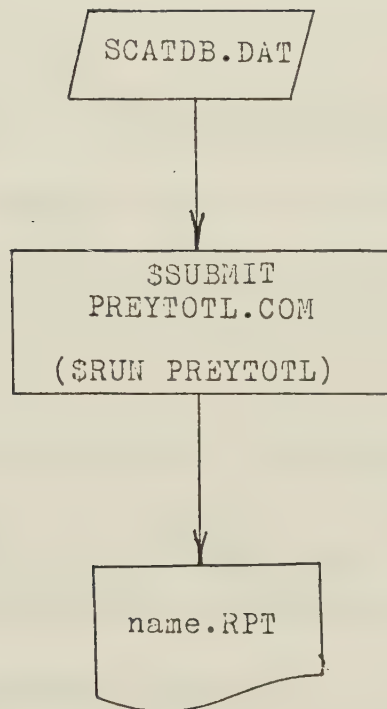


Figure 8. Flow chart for PREYTOTL.

APPENDIX 1

CODING INSTRUCTIONS FOR CARDS 1
OF THE PINNIPED SCAT AND SPEWING
DATA BASE FORM

Last revision date: 85/12/3

****USE PENCIL WHEN FILLING IN CODING SHEET WITH DATA****

****USER MUST GET APPROVAL FROM PERSON IN CHARGE OF THIS DATABASE
PRIOR TO ASSIGNING NEW CODES****

****THE WORD "SAMPLE" = SCAT OR SPEWING****

****Samples may be collected anywhere. If a sample was collected from a LOCATION, AREA, or ISLAND/MAINLAND that is not coded in this form consult with person in charge of maintaining this database before assigning a new code for LOCATION, AREA, and ISLAND/MAINLAND.****

CATEGORY 1: Pre-sorting data

SCAT NUMBERING SYSTEM: [Character 1-9]

1. There are three major segments:

a. COLLECTION DATE: [character 1-6]

(1.) The date the sample was collected.

(2.) Character 1-2 is year (YY)
Character 3-4 is month (MM)
Character 5-6 is day (DD)

b. SERIAL NUMBER: [Character 7-9]

1. A sample is then given a three digit number (right justified) for each sample collected on one day.

2. THIS IS IMPORTANT: The number should not be repeated for the same date used in the first six characters of the serial number from the same island/mainland.

3. Number all samples collected on the same day sequentially without duplicating the number.

c. ISLAND/MAINLAND [Character 10-11]

1. Island or mainland (two digit) code for where the sample was collected at.

ISLAND/MAINLAND CODES:

01 = SAN CLEMENTE ISLAND (SCI)
 02 = SAN NICOLAS ISLAND (SNI)
 03 = SANTA BARBARA ISLAND (SBI)
 04 = CORONADO ISLANDS (CORO)
 05 = MONTEREY, CALIFORNIA (MONT)
 07 = SAN MIGUEL ISLAND (SMI)

CARD NUMBER:[Character 12]

1. There are two different card forms (see Figure 1 and 2).
 - a. Card 1 contains data entries for the basic sample data and is divided into three categories. Category 1 is the pre-sorting data

Category 2 is the soaking data;

Category 3 contains the sorting data.
 - b. Card 2-7 contain prey identification data.
2. Every sample will have at least one card. The second card is used for prey identifications from parts of prey. Use as many cards as necessary until all prey are coded.
3. WHEN MORE THAN ONE CARD IS NEEDED, THE ADDITIONAL CARDS MUST HAVE THE SCAT CODE NUMBER IN THE SAME SEQUENCE AS THE FIRST CARD FOR CHARACTER 1-11.

COLLECTION PERIOD [Character 13-15]

1. The collection period is a consecutive number of all collection "visits" for the island/mainland from where the sample(s) came from. For each visit, samples may have been collected on more than one day.
2. The collection period number groups the different dates for the sampled period to facilitate computer programming. It may include one or several dates.
3. The number is right justified and zero filled.
4. REFER TO APPENDIX 3 for assigned collection period codes.

BLANK[Character 16-17]

AREA CODES: [Characters 18-19]

1. Denotes the specific area within the island or mainland haulout where the sample was collected from.

2. The last two digits of BLM codes are used, unless specified here.
3. The codes are:

SAN CLEMENTE ISLAND

00 Unknown
 01 Mail Point to-and-including Little Cove
 02 South Mail Point to Little Cove
 03 Tiki Head beach (included) to small cliffs
 04 Mail Pt. to Tiki Head beach

SAN NICOLAS ISLAND: BLM codes are used.

00 Unknown	51	=241 & 233	41	=241
21 =221	23	=223	43	=243
33 =233	11	=211	61	=261
34 =234	12	=212	62	=262
42 =242	32	=232		

SANTA BARBARA ISLAND

00 Unknown
 07 BLM 307
 17 Southeast rookery/Main haulout, BLM 317
 25 BLM 325

MONTEREY, CALIFORNIA

00 Unknown
 01 Breakwater

CORONADO ISLAND, MEXICO

00 Unknown
 01 North Island
 02 South Island
 03 Middle Island
 04 Middle Rock

LOCATION CODES: [Character 20-21]

1. Denotes a specific location within an AREA.
 SANTA BARBARA ISLAND: AREA 17

00 Unknown
 01 Entire Southeast rookery
 02 Mid-Southeast rookery
 03 South Mid-southeast rookery

SAN CLEMENTE ISLAND: AREA 01 (Mail Point)

00 Unknown
 01 Jan's Place
 02 Green

- 03 The Ledge
- 04 Tagging Area (Jan's Place + Green + Ledge)
- 05 Flat Area
- 06 Isthmus
- 07 Top Mail Pt.
- 08 Aerial Photo Area, Cactus rock
- 09 Cactus Rock to Cactus Patch
- 10 Cactus Patch to End Flat Area
- 11 Atop 1st Knoll
- 12 Ledge Between Green + Flat Area
- 13 Little Cove

SAN CLEMENTE ISLAND: AREA 02 (South of Mail Point)

- 00 Unknown
- 01 Arch
- 02 Steel Stake Beach
- 03 Upper #1
- 04 Creek Mouth 4
- 05 Upper #2
- 06 Creek Mouth 3
- 07 Upper 3A
- 08 Upper 3B
- 09 Upper 3A + 3B
- 10 Upper #3 Wash
- 11 Creek Mouth 2
- 12 Upper #4
- 13 Creek Mouth #1 w/Log
- 14 Upper #5
- 15 Creek Between Upper #5 + #6
- 16 Upper #6
- 17 Upper #7
- 18 Monolith Rock to Large Rock
- 19 Large Rock to Upper #6

SAN CLEMENTE ISLAND: AREA 03

- 00 Unknown
- 01 Tiki Head Bridge
- 02 Upper at Carolyn's Pool
- 03 Carolyn's Pool
- 04 Tiki Head Beach
- 05 Arroyo Beach
- 06 Mound Beach
- 07 Steve's Place
- 08 Small Cliffs

SAN CLEMENTE ISLAND: AREA 04

- 00 Unknown
- 01 Dead elephant seal beach

SAN NICOLAS ISLAND:

- 00 Unknown for all areas

SAN NICOLAS ISLAND: AREA 33

00 Unknown
 01 High SAM Upper
 02 High FEMALE Upper
 03 S-12 Knoll
 04 Mid-upper

SAN NICOLAS ISLAND: AREA 34

00 Unknown
 01 FEMALE haulout

SAN NICOLAS ISLAND: AREA 42

00 Unknown
 01 242M

MONTEREY, CALIFORNIA

00 Unknown
 -- None assigned

CORONADO ISLAND, MEXICO

00 Unknown
 -- None assigned

HAULOUT TYPE [Character 22-23]

1. When the samples are collected from a location or area (depending on what is being used) the kinds of animals inhabiting the haulout should be recorded for that group of samples.
2. The codes for haulout type are:

00	NO DATA, or Unknown
01	SAM's (Sub Adult Male's)
02	Females w/ pups
03	Females, SAM's
04	Females, SAM's, juveniles
05	Juveniles/pups
06	juveniles
07	females, juveniles, and pups
08	females, juveniles
09	SAM's and adult males
10	females, SAM's, yearlings, and pups
11	juveniles, SAM's, females, and pups
12	SAM'S, juveniles

DATE LOCATION CLEARED: [Character 24-29]

1. Denotes the last time a location within an area, or an area was cleared of samples or checked for their absence.
2. Character 24-25 is year (YY)
Character 26-27 is month (MM)
Character 28-29 is day (DD)
3. If the clear date is unknown leave as BLANK.
4. If the date the sample as collected is the first time that the location was cleared use the collection date as in Characters 1-6.

CLEAR DATE COLLECTION PERIOD: [Character 30-32]

1. This number should correspond to one of the previous collection periods as stated for character 13-15 in Card 1, but which corresponds to the DATE LOCATION CLEARED date.
2. If the clear date does not correspond to a previous collection period/date, then code as BLANK.
3. If the clear date is the same as the collection date code the same as in Characters 13-15.
4. If the clear date is unknown code as triple zero (i.e. 000).
5. REFER TO APPENDIX 3 for collection period codes.

SPECIES CODE: [Characters 33-35]

1. Denotes the species from which the sample came from.

The code are the SWFC marine mammal species codes:

091= Zalophus californianus (California sea lion)
 092= Mirounga angustirostris (Northern elephant seal)
 093= Phoca vitulina (Harbor seal)
 094= Callorhinus ursinus (Northern fur seal)
 095= Eumetopias jubatus (Steller's sea lion)

CATEGORY 2: Soaking data

SCAT/SPEWING [Character 36]

1. The code for denoting if the sample was a scat (feces) or spewing (vomitus).
2. The codes are:

- 1 = scat
- 2 = spewing
- 3 = unknown
- 4 = mixed

NUMBER OF SCATS OR SPEWINGS IN THE SAMPLE [Character 37-38]

1. The majority of samples should only be singles (i.e. coded as 01).
2. Occasionally two or more samples are either inadvertently mixed up, or are purposely placed into a single sample. If the number is either known or estimated, then enter that number.
3. Leave as BLANK when the number of mixed scats or spewings is unknown, or does not represent the entire sample (i.e. partial).
4. The number is right justified and zero filled.

TEXTURE: [Character 39]

1. Defines the freshness of the sample.
2. The codes are:
 - 1 = Fresh
 - 2 = Dry
 - 3 = Partially fresh/dry
 - 4 = Unknown

CATEGORY 3: Sorting data

VOLUME: [Character 40-43]

1. This is the approximate volume of the sample after it soaked. The water in which the sample soaked in is squeezed out and the majority of rocks are removed prior to taking the volume.
2. Volume is expressed in ml's.
3. The number is right justified. Fill in zero's for spaces to the left.
4. Leave BLANK if the volume was not taken or is unknown.

FISH BONES: [Character 44]

1. Were fish bones present in the sample?
 - 1 = YES
 - 2 = NO

3 = Not known, data not collected

OTOLITHS FOUND? [Character 45]

1. Were any otoliths (either complete or fragments) found in the sample?

1 = YES

2 = NO

3 = Not known, data not collected

2. All otoliths (either complete or fragments) are saved for making identifications of prey.

3. If this field was originally marked as yes (code 1) and after inspection under the microscope discloses that the object is not an otolith, then change to NO (code 2) and evaluate END OF DATA (character 80 in CARD 1).

BEAKS FOUND? [Character 46]

1. Were any cephalopod beaks (either complete or fragments) found in the sample?

1 = YES

2 = NO

3 = Not known, data not collected

2. All cephalopod beaks (either complete or fragments) are saved for making identifications of prey.

3. If this field was originally marked as yes (code 1) and after inspection under the microscope discloses that the object is not an otolith, then change to NO (code 2) and evaluate END OF DATA (character 80 in CARD 1).

PLEURONCODES PARTS FOUND? [Character 47]

1. Were any fragments of the pelagic red crab, Pleuroncodes planipes, found in the sample?

1 = YES

2 = NO

3 = Not known, data not collected

PARASITES FOUND? [Character 48]

1. Were any parasites found in the sample?

1 = YES

2 = NO

3 = Not known, data not collected

ROUND EYE LENSES PRESENT ? [Character 49]

1. Round eye lenses belong to fish. They are completely spherical.
2. Were round/spherical eye lenses found in the sample?
 - 1= yes
 - 2= no
 - 3= Not known, data not collected

HOW MANY ROUND EYE LENSES WERE PRESENT IN THE SAMPLE? [Character 50-52]

"OPTIONAL"

1. Denotes the number of spherical eye lenses which were counted from the sample.
2. BLANK = no data, or lenses not counted.
3. The number is right justified; fill in remaining spaces on the left with zeros.

FLAT EYES LENSES PRESENT ? [Character 53]

1. Flat sided eye lenses belong to cephalopods.
2. Were flat eye lenses found in the sample?
 - 1= yes
 - 2= no
 - 3= Not known, data not collected

HOW MANY FLAT EYE LENSES WERE PRESENT IN THE SAMPLE? [Character 54-56]

"OPTIONAL"

1. Denotes the number of "half spherical" eyes lenses found in the sample. This type of eye lense has a "flat" side.
2. BLANKS = no data
3. The number is right justified; fill in remaining spaces on the left with zeros.

BLANK [Character 57-79] ----"CAN BE USED AS A NOTE SECTION"

*****Samples collected by Carolyn Heath have her sample identification number in 1:57-1:59. These are found for island code 02 and 03. Carolyn Heath's scat size code is in 1:60 (questionable size code is designated by code ? in 1:61). Partial samples are designated as code P in 1:62.

END OF DATA? [Character 80]

1. The code to tell the computer that the sample has data on other cards; or that no more data exists for that sample.
2. The codes are:
 - 1 = Data ends. There is no more data.
 - 2 = The data does not end, more data follows on card(s) 2-7.
3. Proceed to the next card with the necessary data if "2" is entered.

*****END DATA FIELDS FOR CARD 1*****

DOUBLE CHECK ALL FIELDS FOR ACCURACY IN CARD 1

APPENDIX 2

CODING INSTRUCTIONS FOR CARDS 2-7 OF THE
PINNIPED SCAT AND SPEWING DATABASE FORM

Last revision date: 85/12/3

*** "PREY CARD" ***

*** "Repeat Characters 1-11 as in CARD 1" FOR EACH SAMPLE***

****IF the otoliths and/or beaks that were collected during sample screening were found under close inspection to be shells, or other material (i.e. not otoliths or beaks), AND no other prey identifications which belong in the "PREY CARD" were made for the sample, OMIT THIS CARD (i.e. card 2). Evaluate Character 80 in CARD 1 for end of data and change Characters 45 and 46 from code "1" to code "2" whenever appropriate.****

CARD NUMBER [Character 12]

1. For each sample use as many cards as are needed to code all of the prey found.
2. Remember to code Characters 1-11 for each "PREY CARD" the same for each individual sample.
3. Number the cards sequentially as you need them.
4. THE FIRST PREY CARD IS always CODED AS "2".

UNIDENTIFIED OTOLITH PARTS ? [Character 13]

1. Were any unidentifiable otolith fragments found in the sample?

1 = yes
2 = no
3 = unknown

2. *Leave blank for cards 3-7*

UNIDENTIFIED CEPHALOPOD BEAK PARTS? [Character 14]

1. Were any unidentifiable cephalopod beak fragments found in the sample?

1 = yes
2 = no
3 = unknown

2. *Leave blank for cards 3-7*

UNIDENTIFIED SECONDARY OTOLITHS ? [Character 15]

1. Were any secondary otoliths (lapillus and asteriscus) found in the sample?

1 = yes
 2 = no
 3 = unknown

2. *Leave blank for cards 3-7*

PREY:

1. A particular prey and the information relating to it are listed in groups of sixteen characters.

- a. There are four groups in each card. Therefore, up to four prey can be coded per card.

Characters 16-31
 Characters 32-47
 Characters 48-63
 Characters 64-79

- b. One prey per group.

2. Each group of sixteen characters has eight fields of information. The fields are:

Field 1: PREY CODE [three characters]

- a. Contains the specific code number assigned to each prey.
- b. The codes are listed in APPENDIX 4.
- c. BLANK IF NO PREY ARE LISTED

Field 2: IDENTIFICATION CERTAINTY CODE [one character]

- a. Was the identification positive, questionable (if too digested, etc.), or related (i.e. c/f) for the prey code used in the group?
- b. The codes are:

1 = Positive identification
 2 = Questionable identification (?)
 3 = related identification (c/f)
 BLANK if field for prey code is blank.

Field 3: LEFT/TOP [three characters]

- a. Gives the count of either left otoliths or upper cephalopod beaks found for the prey being listed in Field 1.
- b. The number is right justified.
- c. ZEROS if no data and a prey is coded in the prey group. (000)
- d. BLANK if field for prey code is blank.

Field 4: RIGHT/BOTTOM [three characters]

- a. Gives the count of either right otoliths or lower cephalopod beaks found or the prey being listed in the group.
- b. The number is right justified.
- c. ZEROS if no data and a prey is coded in the prey group.
- d. BLANK if field for prey code is blank.

Field 5: SIDE UNKNOWN [three characters]

- a. If otoliths or beaks were found but the side was not determinable for the identification and the certainty code then list the count here.
- b. The number is right justified.
- c. ZEROS if no data and a prey is coded in the prey group.
- d. BLANK if field for prey code is blank.
- e. Code 999 will be found for 1981-1983 data which was transferred from an old database format to this format.

Field 6: PIECES ? [one character]

- a. Were any pieces found for the coded prey and certainty code?
 - 0 = 1981-1983 data which was transferred from an old database format to this format.
 - 1 = yes
 - 2 = no
 - 3 = unknown
- BLANK if field for prey is blank.

Field 7: PREY IMPORTANCE [one character]

- a. It codes a certain group of prey found in the diet of the animal.
- c. For California sea lions, Zalophus californianus, the important prey are:

Code 1: Merluccius productus
Engraulis mordax
Trachurus symmetricus
Scomber japonicus
Chromis punctipinnis
Sebastes spp.
Loligo opalescens

Code 2: Flatfishes

Code 3: Embiotocids

Code 4: Myctophids

Code 5: Other cephalopods

Code 6: Other fish

Code 7: Crustacean

Code 8: UNKNOWN/ or OTHER

Field 8: PREY CATEGORY [one character]

- a. The code for denoting the type of phylogenetic prey which were identified.
- b. The prey category type codes are:

1 = fish

2 = cephalopod

3 = crustacean

4 = other

END OF DATA? [Character 80]

- 1. Does the data for this sample end?

1 = YES, there is NO more data.

2 = There is more data for this sample.

- 2. Proceed to next card with the necessary data if "2" is entered.

DOUBLE CHECK ALL FIELDS FOR ACCURACY IN CARD 2-7

APPENDIX 3

LIST OF SEQUENTIAL COLLECTION PERIODS
 USED FOR THE PINNIPED SCAT AND SPEWING DATABASE SCATDB.DAT
 (Last date entered for each island denotes last update date)

SAN CLEMENTE ISLAND (CODE 01)		SAN NICOLAS ISLAND (CODE 02)		SANTA BARBARA ISLAND (CODE 03)	
Collection period	Date(s)	Date(s)		Date(s)	
1	81/9/9-10	81/6/22		81/7/24-26	
2	81/10/14-15	81/7/4-5		81/8/14	
3	81/11/15	81/7/16-18		82/7/29-30	
4	82/1/28	81/8/7-8		83/6/29	
5	82/3/24	81/8/??		83/8/23-24	
6	82/4/27-29	81/9/??		84/2/8-9	
7	82/5/13	81/10/31-11/1		84/7/12	
8	82/5/26-27	81/11/15		84/9/5-8	
9	82/6/30	81/12/4			
10	82/7/14	82/1/2-8			
11	82/7/28-29	82/3/3-7			
12	82/8/21	82/3/13			
13	82/11/2-5	82/3/??			
14	82/12/28-29	82/4/8			
15	83/2/26	82/6/20			
16	83/3/18-20	82/7/10-12			
17	83/4/15-17	82/7/22-26			
18	83/5/13-15	82/8/6-8			
19	83/6/25	82/8/14			
20	83/7/22-23	82/9/26			
21	83/11/04-06	82/10/23			
22	83/12/16-18	82/11/15			
23	84/1/20-22	82/11/27 (missing)			
24	84/2/24-26	83/2/27			
25	84/3/23-25	83/4/16-17			
26	84/5/3-6	83/5/15-16			
27	84/6/15-16	83/5/23			
28	84/7/21	83/5/28-29			
29	84/7/26-27	83/6/5			
30	84/9/20-22	83/6/24			
31	84/11/16	83/6/25 (missing)			
32	85/1/12	83/6/27			
33	85/3/9	83/6/30			
34	85/6/8	83/7/1			
35	85/8/2-5	83/7/5			

APPENDIX 3 (continued)

LIST OF SEQUENTIAL COLLECTION PERIODS
 USED FOR THE PINNIPED SCAT AND SPEWING DATABASE SCATDB.DAT
 (Last date entered for each island denotes last update date)

Collection period	SAN CLEMENTE ISLAND (CODE 01)	SAN NICOLAS ISLAND (CODE 02)	SANTA BARBARA ISLAND (CODE 03)
	Date(s)	Date(s)	Date(s)
36	85/9/6-8	83/7/11	
37		83/7/15-17	
38		83/8/3	
39		83/8/6-7	
40		83/9/14	
41		83/10/22	
42		83/11/19	
43		84/1/5	
44		84/1/20	
45		84/2/27	
46		84/3/31	
47		84/4/25	
48		84/5/29-31	
49		84/6/9-10	
50		84/6/17-19	
51		84/6/23-24	
52		84/7/2	
53		84/7/6	
54		84/7/9	
55		84/7/26	
56		84/9/21-23	
57		84/10/23	
58		84/11/20	
59		84/12/28	
60		85/1/17	
61		85/2/24	
62		85/3/8	
63		85/4/21	
64		85/5/26	
65		85/6/29	
66		85/7/20	
67		85/8/24-25	
68		85/9/13-15	

APPENDIX 4

PREY CODES
IN THE PINNIPED SCAT AND SPEWING
DATABASE SCATDB.DAT

Last revision date 85/06/20

Code numbers can be assigned to empty spaces when new prey are not listed in this list are found in a sample.

001	<u>Merluccius productus</u>
002	<u>Engraulis mordax</u>
003	<u>Trachurus symmetricus</u>
004	<u>Scomber japonicus</u>
005	<u>Chromis punctipinnis</u>
006	<u>Sebastes spp.</u>
007	<u>Porichthys notatus</u>
008	<u>Sebastolobus alascanus</u>
009	
010	<u>Loligo opalescens</u>
011	<u>Octopus sp.</u>
012	
013	<u>Gonatus sp.</u>
014	<u>Abraliopsis felis</u>
015	<u>Abraliopsis falco</u>
016	<u>Onychoteuthis borealijaponicus</u>
017	<u>Berryteuthis anonychus</u>
018	<u>Ocythoe tuberculata</u>
019	<u>Moroteuthis robusta</u>
020	<u>Mastigoteuthis pyrodes</u>
021	<u>Mastogoteuthis dentata</u>
022	GONATIDAE
023	<u>Octopodoteuthis deletron</u>
024	<u>Cypselurus californicus</u>
025	SCOMBRIDAE
026	<u>Prionace glauca</u>
027	<u>Galeorhinus galeus</u>
028	<u>Girella nigricans</u>
029	UNIDENTIFIED FLATFISH
030	UNIDENTIFIED CEPHALOPOD
031	UNIDENTIFIED SHARK TOOTH
032	UNIDENTIFIED FISH TOOTH
033	UNIDENTIFIED CRUSTACEAN PARTS
034	cartilaginous FISH VERTEBRAE
035	UNIDENTIFIED UNKNOWN
036	UNIDENTIFIED FISH
037	MYCTOPHIDAE
038	<u>Careproctus melanurus</u>
039	LABRIDAE
040	<u>Semicossyphus pulcher</u>
041	<u>Icichthys lockingtoni</u>
042	<u>Oxyjulis californica</u>
043	<u>Medialuna californiensis</u>
044	<u>Synodus lucioceps</u>

(APPENDIX 4 continued)

045	SCIANIDAE	
046	<u>Seriphus politus</u>	
047	<u>Genyonemus lineatus</u>	
048	COTTIDAE	
049	<u>Paralabrax nebulifer</u>	
050	<u>Leuresthes tenuis</u>	
051	ATHERINIDAE	
052	<u>Atherinops affinis</u>	
053	<u>Atherinopsis californiensis</u>	
054	<u>Argentina sialis</u>	
055	<u>Ophidion scrippsae</u> (= <u>Otophidium scrippsi</u>)	
056	<u>Chilara taylori</u>	
057	EMBIOTOCIDAE	--1
058	<u>Phanerodon furcatus</u>	1
059	<u>Rhacochilus toxotes</u>	1
060	<u>Cymmatogaster gracilis</u>	1-- "Surfperches"
061	<u>Cymmatogaster aggregata</u>	1
062	<u>Zalembeius rosaceus</u>	--1
063		
064		
065		
066		
067	<u>Citharichthys sp.</u>	--1
068	<u>Hippoglossina stomata</u>	1
069	<u>Symphurus atricauda</u>	1
070	<u>Lyopsetta exilis</u>	1
071	<u>Citharichthys stigmaeus</u>	1
072	<u>Citharichthys sordidus</u>	1-- "Flatfishes"
073	<u>Glyptocephalus zachirus</u>	1
074	<u>Parophrys vetulus</u>	1
075	<u>Microstomas pacificus</u>	--1
076	<u>Zaniolepis latipinnis</u>	
077	<u>Zaniolepis frenata</u>	
078	<u>Zaniolepis sp.</u>	
079	<u>Lycodes (Aprodon) corteziianus</u>	
080	<u>Lycodopsis pacifica</u>	
081	ZOARCIDAE	
082	<u>Spirinchus starksi</u>	
083	<u>Paralabrax clathratus</u>	
084	<u>Leuroglossus stilbius</u>	
085	GOBIIDAE	
086	STICHAEDAE	
087	<u>Xeneretmus sp.</u>	
088	<u>Xeneretmus triacanthus</u>	
089	<u>Xeneretmus ritteri</u>	
090	<u>Stenobranchius leucopsarus</u>	
091	<u>Ceratoscopelus townsendi</u>	
092	<u>Symbolophorus californiensis</u>	
093		
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APPENDIX 5

PINNIPED SCAT AND SPEWING DATABASE
VARIABLE VERIFICATION CROSS-REFERENCE CHECKS

Cards 1

VARIABLE NAME		INTERNAL FIELD EDITS			
				RANGE	
		CHAR	BLANK		
NAME	COL	TYPE	OK?	LOWER	UPPER
Year Collected	1-2	N	N	79	90
Month Collected	3-4	N	N	1	12
Day Collected	5-6	N	N	1	31
Serial Number	2-9	N	N	1	400
Island/Mainland	10-11	N	N	01	09
Card 1	12	N	N	1	1
Collection Period	13/15	N	N	001	100
(Blank)	16-17		Y		
Area	18-19	N	N	00	75
Location	20-21	N	N	00	25
Haulout Type	22-23	N	N	00	25
Year Cleared	24-25	N	Y	79	90
Month Cleared	26-27	N	Y	1	12
Day Cleared	28-29	N	Y	1	31
Collection Period Cleared	30-32	N	Y	000	100
Species	33-35	N	N	091	095
Scat/Spewing	36	N	N	1	4
Number of Scats/Spewings					
in Sample	37-38	N	Y	01	50
Texture (Freshness	39	N	N	1	5
Volume	40-43	N	Y	0001	5000
Fish Bones?	44	N	N	1	3
Fish Otolith?	45	N	N	1	3
Cephalopod Beaks?	46	N	N	1	3
<u>Pleuroncodes</u> Parts?	47	N	N	1	3
Parasites?	48	N	N	1	3
Fish (Round) Eye Lenses?	49	N	N	1	3
Number of Fish Eye Lenses	50-52	N	Y	000	500
Cephalopod (Flat) Eye					
Lenses?	53	N	N	1	3
Number of Cephalopod Eye					
Lenses?	54-56	N	Y	000	500
(Blank) Used of Notes	57-79		Y		
End of Data?	80	N	N	1	2

CHAR TYPE: N = NUMERIC

BLANK OK?: N = NO, Y = YES

APPENDIX 5 (Cont.)

PINNIPED SCAT AND SPEWING DATABASE
VARIABLE VERIFICATION CROSS-REFERENCE CHECKS

Cards 2-7

VARIABLE NAME		INTERNAL FIELD EDITS			
NAME	COL	CHAR	BLANK	RANGE	
				LOWER	UPPER
Year	1-2	N	N	79	90
Month	3-4	N	N	1	12
Day	5-6	N	N	1	31
Serial Number	2-9	N	N	1	400
island/Mainland	10-11	N	N	01	09
Card 2-7	12	N	N	2	7
Unidentified Otolith Fragments?	13	N	N	1	3
Unidentified Cephalopod Beak Fragments?	14	N	N	1	3
Unidentified Secondary Otoliths	15	N	N	1	3
Prey Species Code	16-18	N	Y	001	100
Identification Certainty Code	19	N	Y	1	3
Number of Left Otoliths or Lower Cephalopod Beaks	20-22	N	Y	000	300
Number of Right Otoliths or Lower Cephalopod Beaks	23-25	N	Y	000	300
Number of Side Unknown Pieces?	26-28	N	Y	000	300
Prey Importance Code	29	N	Y	0	3
Prey Category	30	N	Y	1	6
Prey Species Code	31	N	Y	1	4
Prey Species Code	32-34	N	Y	001	100
Identification Certainty Code	35	N	Y	1	3
Number of Left Otoliths or Upper Cephalopod Beaks	36-38	N	Y	000	300
Number of Right Otoliths or Lower Cephalopod Beaks	39-41	N	Y	000	300
Number of Side Unknown Pieces?	42-44	N	Y	000	300
Prey Importance Code	45	N	Y	0	3
Prey Category	46	N	Y	1	6
Prey Category Code	47	N	Y	1	4

CHAR TYPE: N= NUMERIC

BLANK OK?: N = NO, Y = YES

APPENDIX 5 (Cont.)

PINNIPED SCAT AND SPEWING DATABASE
VARIABLE VERIFICATION CROSS-REFERENCE CHECKS

Cards 2-7

VARIABLE NAME		INTERNAL FIELD EDITS			
NAME	COL	CHAR BLANK		RANGE	
		TYPE	OK?	LOWER	UPPER
Prey Species Code	48-50	N	Y	001	100
Identification Certainty Code	51	N	Y	1	3
Number of Left Otoliths or Lower Cephalopod Beaks	52-54	N	Y	000	300
Number of Right Otoliths or Lower Cephalopod Beaks	55-57	N	Y	000	300
Number of Side Unknown Pieces?	58-60	N	Y	000	300
Prey Importance Code	61	N	Y	0	3
Prey Category	62	N	Y	1	6
Prey Species Code	63	N	Y	1	4
Identification Certainty Code	64-66	N	Y	001	100
Number of Left Otoliths or Upper Cephalopod Beaks	67	N	Y	1	3
Number of Right Otoliths or Lower Cephalopod Beaks	68-70	N	Y	000	300
Number of Side Unknown Pieces?	71-73	N	Y	000	300
Prey Importance Code	74-76	N	Y	000	300
Prey Category Code	77	N	Y	0	3
End of Data	78	N	Y	1	6
	79	N	Y	1	4
	80	N	Y	1	2

CHAR TYPE: N= NUMERIC BLANK OK?: N = NO, Y = YES

APPENDIX 6

PINNIPED SCAT AND SPEWING DATABASE
LOGICAL ERROR CRITERIA CHECKS

- 001 If the end of data (1.80) equals 1, then otoliths (1.45) and beaks (1.46) must each equal 2.
- 002 If the end of data (1.80) equals 1, then otoliths (1.45) and beaks (1.46) must each equal 1.
- 003 The collection date (1.1-1.6) must equal or be older than location clear date (1.24-1.29).
- 004 The collection (1.13-1.15) must equal or be greater than location clearing collection period (1.30-1.32).
- 005 If number of round eye lenses (1.50-1.52) is greater than 0, then round eye lenses (1.49) must equal 1.
- 006 If number of flat eye lenses (1.54-1.56) is greater than 0, then flat eye lenses (1.53) must equal 1.
- 007 If prey species code (2.16-2.18) equals blank, then 2.19-2.31 must equal blank.
- 008 If prey species code (2.16-2.18) is not equal blank, then 2.19-2.31 must not equal blank.
- 009 If prey species code (2.32-2.34) equals blank, then 2.35-2.46 must equal blank.
- 010 If prey species code (2.32-2.34) is not equal blank, then 2.35-2.47 must not equal blank.
- 011 If prey species code (2.48-2.50) equals blank, then 2.51-2.63 must equal blank.
- 012 If prey species code (2.48-2.50) is not equal blank, then 2.51-2.63 must not equal blank.
- 013 If prey species code (2.64-2.66) equals blank, then 2.67-2.79 must equal blank.
- 014 If prey species code (2.64-2.66) is not equal blank, then 2.67-2.79 must not equal blank.
- 015 If card 2.12 is greater than or equal to 3, then 3.13, 3.14, and 3.15, etc, must equal blank.

APPENDIX 7

CALCULATIONS MADE BY
PREYOKUR.FOR, SCATNUM.FOR, AND PREYTOTL.FOR

OCCURRENCE

The occurrence computation made by the FORTRAN programs PREYOKUR.FOR and PREYTOTL.FOR is defined as the number of samples in which prey x was found (i.e. occurred) divided by the total number of samples (it includes scats with and without coded prey) in the sampled period. It indicates the number and percentage of scat samples having a particular prey. The summation of percent occurrences will almost never equal 100% because more than one prey can be represented in a scat sample. In the literature it is often referred to as "percent frequency of occurrence" and "percent occurrence".

$$PO = o/s \times 100 \quad (1)$$

where PO = percent occurrence (i.e. percent frequency of occurrence)

o = number of samples with prey x

s = number of all samples in the sampling period

(note: PREYOKUR includes scats with and without prey)

If the user desires the PO of scats with prey identifications (i.e. coded prey) it must be computed separately by hand. The program PREYPER.FOR lists the number of scats which had no prey present. This number is subtracted from the total of all scats shown by PREYOKUR.FOR and PREYTOTL.FOR. The new PO is then taken from the sub-total that includes scats that had coded prey present. This hand correction only applies to the OCCURRENCE computation in PREYOKUR and PREYTOTL.

STANDARD OCCURRENCE

The standard occurrence computation used in the FORTRAN programs PREYOKUR.FOR and PREYTOTL.FOR determine the percentage of each prey occurrence from the sum of occurrences of all prey found in the samples. This was done because the summations of percent occurrences almost never equal one hundred percent due to more than one prey being represented in a single scat sample. When the FORTRAN programs PREYOKUR.FOR and PREYTOTL.FOR were written this computation was called standard occurrence for lack of another term. Later when the reports on the food habits of California sea lions were being written it was decided that this term was vague and that the term "composition of prey" more accurately described the computation. Therefore, "standard

occurrence", as found in the summary reports of PREYOKUR.FOR and PREYTOTL.FOR, is synonymous with "composition of prey".

MINIMUM NUMBER

The computation made by SCATNUM.FOR and PREYTOTL.FOR describes the minimum number of individual prey from the counts made of the right and left otoliths for fish, and the upper and lower beaks for cephalopods for all samples collected in the sampling period. In many instances these hard parts were not found in equal number for each sample. For example, 10 right otoliths and 3 left otoliths of prey x were found in a sample. Because otoliths occur in pairs, the three left otoliths in this example may not have come from the same group of fish which yielded the ten right otoliths. However, for this example, the maximum count of 10 right otoliths represent at least a minimum number of ten individual fish (the 3 lefts not being counted). Therefore, the maximum count of either left or right otoliths, or either upper or lower beaks, provides the minimum number of individual prey found for each prey in a single sample. The same principle hold for cephalopods because they posses a pair of beaks. The percentage represented by each species of fish or cephalopod is then computed from the sum of all the individuals from all prey represented in the sampling period. This computation excludes: (1) all prey hard parts found which were broken or digested and thus could not be categorized as left or right otoliths, and upper or lower beaks; (2) differences in the size of individual otoliths and beaks which come from different individuals when equal numbers of left and right otoliths, or upper and lower beaks were counted for the same scat; and (3) prey that were not represented by fish otoliths or cephalopod beaks (e.g. shark teeth).

